

THE INTRINSIC UV/SOFT X-RAY SPECTRUM OF QUASARS

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Abstract.

The detection of a HeII absorption trough in the spectra of three high-redshift quasars provides new constraints on the spectral shape of the UV extragalactic background. The relative strengths of the observed flux decrements at the rest-frame wavelengths of 1216 and 304 Å require a relatively soft radiation field at 4 ryd compared to 1 ryd. If the ionizing metagalactic flux is dominated by the integrated light from QSOs, and the HeII reionization of the universe was completed well before $z \sim 3$, then the UV/soft X-ray spectrum of individual quasars at these epochs must, once the cosmological “filtering” through material along the line of sight is taken into account, satisfy similar constraints on the average. We model the propagation of AGN-like ionizing radiation through the intergalactic medium using CUBA, a numerical code developed in our prior work. We show that, in order to explain the reported HeII absorption, any thermal component responsible for the “soft X-ray excess” observed in the spectra of AGNs at $z \lesssim 0.3$ must, at $z \sim 3$, have a typical temperature $\gtrsim 80$ eV, and a luminosity not exceeding $\approx 20\%$ of that of the “UV bump”.

1. Results

By means of the code named CUBA (described in HMI), we have calculated the ratio $\eta \equiv N_{\text{HeII}}/N_{\text{HI}}$ for a set of QSO spectral models as discussed in HMII.

The HI and HeII opacities computed with various QSO background models have been then tested against the observed values. Together with the already mentioned HeII data, we have taken a collection of HI data. The calculated redshift dependent HeII D_A (the fractional flux decrement shortward of Ly α) is shown in Figure for different input QSO spectral models, together with the available data points. In the left upper panel we plotted also HI D_A against the data.

From the Figure it is evident that:

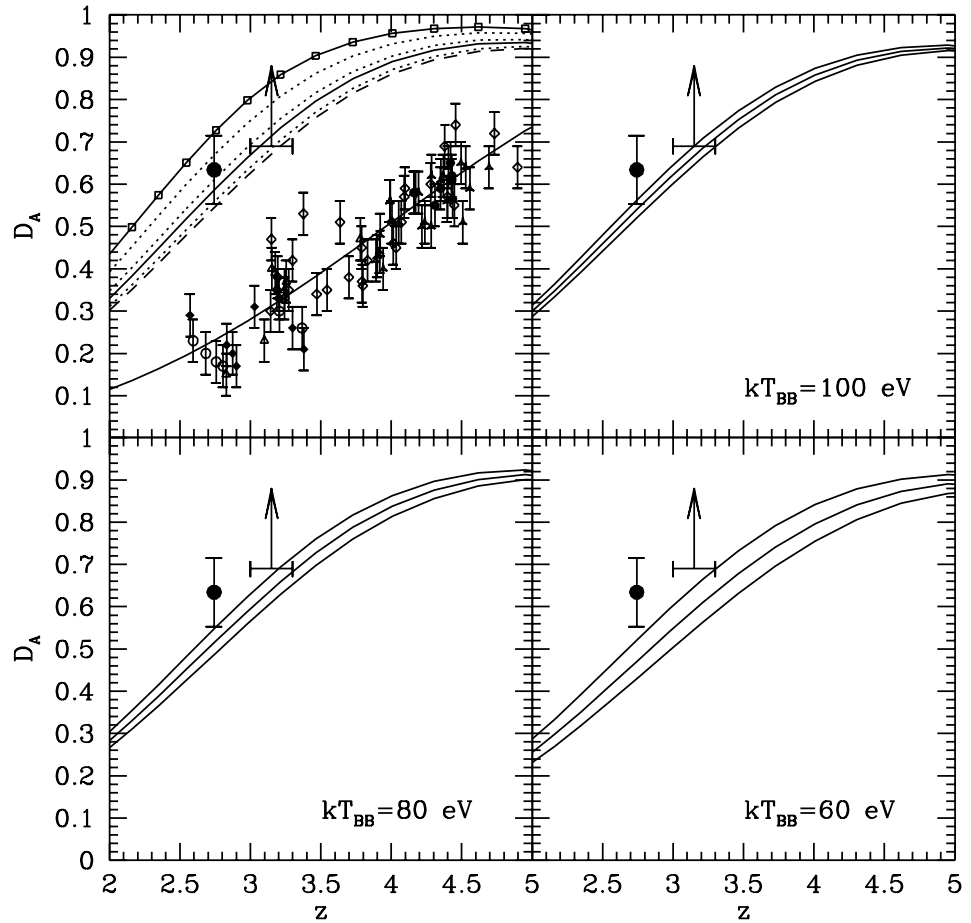


Figure 1. The quantity D_A for HI and HeII computed for various QSO spectral models is tested against existing data.

- The spectral slope below $\sim 1000\text{\AA}$ of integrated QSO spectrum must be comprised between 1.5 and 2.
- The soft excess observed in QSO spectra at $z \lesssim 0.3$ must have at $z \sim 3$ a temperature $\gtrsim 80 \text{ eV}$, and a luminosity not exceeding $\approx 20\%$ of that of the UV bump.

A detailed analysis and discussion, with all the relevant references, will appear in HMII.

References

- Haardt F., Madau P., 1996, ApJ, 461, 20 (HMI)
 Haardt F., Madau P., 1996, in prep. (HMII)